4°)

a- $E = \frac{q^2}{2c} + \frac{1}{2}Li^2$

b- $E_e = E - E_L \Rightarrow E_e = E - \frac{1}{2}Li^2$

c-

i- $E = 3{,}5.10^{-4}\,J$;

$E = \frac{1}{2}L\,I_m^2 \Rightarrow L = \frac{2E}{I_m^2} = \frac{2x3{,}5.10^{-4}}{\left(1{,}2\pi 10^{-2}\right)^2} \Rightarrow L = 0{,}484H$

ii-

* $E_e = E_L \Rightarrow E_L = \frac{1}{2}Li^2 \Rightarrow i = \pm\sqrt{\frac{2E}{L}} \Rightarrow i = \pm 27{,}88mA$

* $E_e = \frac{E}{2} = \frac{q_2}{2c} \Rightarrow q = \pm\sqrt{C.E} \Rightarrow q = \pm 8{,}36.10^{-6}\,C$

Exercice N°10

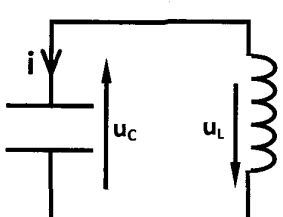
1°)

a- $Q_0 = C.U_0$

b-

* en applique la loi des mailles

$u_c + u_L = 0$



or $u_c = \frac{q}{c}$ et $u_L = L\frac{d^2q}{dt^2}$ d'ou $\frac{d^2q}{dt^2} + \frac{q}{LC} = 0$

* L'équation différentielle admet une solution de la forme : $q(t) = Q_m \sin(\omega t + \varphi_q)$

$\Rightarrow$ Les oscillations sont sinusoïdales

c-

i- $E = E_e + E_L$ or $E_e = \frac{q^2}{2c}$ et $E_L = \frac{1}{2}Li^2$

d'ou $E = \frac{q^2}{2c} + \frac{1}{2}Li^2$

ii-

$\frac{dE}{dt} = \frac{q}{c}\frac{dq}{dt} + L\frac{dq}{dt}.\frac{d^2q}{dt^2} = \frac{dq}{dt}\left(L\frac{d^2q}{dt^2} + \frac{q}{c}\right)$

$\Rightarrow \frac{dE}{dt} = 0 \Rightarrow E = C^{te} \Rightarrow$ **oscillation non amortie.**

iii- $\frac{1}{2}Li^2 = E - \frac{q^2}{2C} \Rightarrow i^2 = \frac{2E}{L} - \frac{q^2}{LC}$

2°) L'équation de la courbe : $i^2 = a\,q^2 + b$

avec $b = 10^{-4}A^2$ et $a = -10^{+6}\frac{A^2}{C^2}$

d'ou $i^2 = -10^{+6}q^2 + 10$

a- Pour $q^2 = 0$

$\Rightarrow i = I_m$ d'ou $I_m^2 = 10 \Rightarrow I_m = 10$ A

b- $\frac{1}{LC} = 10^{+6} \Rightarrow \frac{1}{\sqrt{LC}} = \omega_0 = 10^{+3}\,rad.s^{-1}$